GEOLOGICAL SURVEY OF CANADA
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MINERAL RESOURCES OF CANADA

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BULLETIN

ON

MOLYBDENUM AND TUNGSTEN

BY

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WITH NOTES BY C. W. WILLIMOTT

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MOLYBDENUM AND TUNGSTEN

By R. A. A. Johnston.

MOLYBDENUM.

Molybdenum is an essential constituent of the following minerals :— molybdenite or sulphide of molybdenum; molybdite or molybdic oxide : wulfenite, molybdate of lead or yellow lead-ore; powellite, molybdate and tungstate of calcium; belonesite or molybdate of magnesia; ilsemannite, supposed to be a molybdate of molybdic oxide. Of these molybdenite and molybdite are the only ores of molybdenum which have so far been reported as occurring in Canada. They form the source of by far the greater portion of the molybdenum of commerce, molybdenite being the more important of the two. As for the other ores of molybdenum mentioned above, wulfenite alone has ever attained any economic importance and that only to a very limited extent, the supply being so small and uncertain as to be almost inconsiderable. The remaining ores do not possess other than a purely scientific interest. Ores of Molybdenum.

Molybdenite, free from impurities, contains 60 per cent of molybdenum and 40 per cent of sulphur. It occurs sometimes in tabular hexagonal crystals, but more often in foliated masses. It is a soft sectile mineral with a hardness of 1 to 1·5 and a specific gravity of 4·7 to 4·8. It has a pure lead-gray colour and metallic lustre. On white paper it affords a bluish-gray streak and on porcelain a slightly greenish streak. Before the blowpipe, it is infusible but imparts a yellowish-green colour to the flame. On charcoal the pulverized mineral gives, in the oxidising flame, a strong odour of sulphur dioxide, the coal at the same time becoming coated with crystals of molybdic oxide, which are yellow while hot and white after cooling. This coating acquires an azure-blue colour if touched intermittently with the reducing flame. Molybdenite is decomposed by nitric acid with separation of a white or grayish-white residue of molybdic oxide.

Previous to the year 1778 much confusion existed as to the identity of molybdenite and graphite, owing to the close resemblance of the two minerals but in that year Scheele showed that whereas graphite was Means of identifying molybdenite.

entirely consumed on prolonged ignition molybdenite on the other hand left a white crystalline oxide. And in 1782 Hjelm succeeded in isolating the metal itself. Molybdenite is readily distinguished from graphite by its greater specific gravity, by its greenish streak on porcelain and by its chemical properties.

Molybdenite is often found disseminated through granite, gneiss, limestone and other crystalline rocks, but frequently in greater abundance in quartz-veins traversing such rocks. In some instances where the enclosing silicious gangue has been removed or disintegrated through atmospheric or aqueous agencies or both, the molybdenite has been found loose in the soil, having apparently suffered but little alteration.

Molybdite or molybdic oxide, the earthy varieties of which are also known as molybdic ochre, contains under normal conditions 66·7 per cent of metallic molybdenum. It occurs in capillary crystallizations, tufted and radiated; also subfibrous and as an earthy powder or incrustation. The lustre of the crystals is generally silky or adamantine, less often pearly. The colour varies from straw-yellow to yellowish-white. The hardness varies from 1 to 2 and the specific gravity from 4·49 to 4·5. This mineral frequently occurs in association with molybdenite from which it has been derived by oxidation.

Estimation of Molybdenum in its Ores.

The following methods are in common use for the estimation of molybdenum in its ores.

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Gravimetric method of H. Borntraeger:—About one gramme of the powdered ore is digested in an Erlenmeyer flask with 25 c.c. of concentrated nitric acid for two hours in order to convert the molybdenum into molybdic acid. The latter is dissolved in ammonia and filtered off: the residue is treated a second time with nitric acid and ammonia: the combined filtrate is then acidified with nitric acid and evaporated to dryness. The molybdic acid is separated from the dry ammonium nitrate by digesting and washing with 50 per cent alcohol, which dissolves only the ammonium nitrate. The molybdic acid is then collected on a weighed filter or dissolved in normal ammonia and the excess of ammonia titrated with standard acid.

Volumetric method.—About one gramme of the finely powdered mineral is fused with sufficient sodium peroxide in a nickel crucible. The mass is then allowed to cool, after which the melt is dissolved in H^2SO^4. The solution is then neutralized with NH^4OH and the pre-

cipitated ferric oxide filtered off and washed. The filtrate is now acidulated with H^2SO^4 and passed through a column of metallic zinc (Jones reductor) and titrated with potassium permanganate.

Electrolytic method of L. H. Pollock and Edgar F. Smith :—The finely divided ore is fused with Na^2CO^3 and $NaNO^3$; the melt after cooling is digested in water, filled and washed. The filtrate is acidified with $HC^2H^3O^2$ and the molybdenum is precipitated electrolytically as a black adherent coating of hydrated molybdenum sesquioxide, which is dissolved in HNO^3 and weighed as molybdic oxide.

Metallurgy.

Metallurgy. Pure ammonium molybdate is ignited and molybdic oxide is mixed with carbon in the proportion of ten to one and the mixture subjected for six minutes to the arc produced by a current of 800 amperes and 60 volts, care being taken to avoid complete fusion of the mass and resultant union of the molybdenum with free carbon present.

Molybdate of calcium is heated with carbon.

Molybdenite—native sulphide of molybdenum—is heated in a carbon tube with an arc of 350 amperes and 60 volts ; sulphur dioxide is evolved and when the current is increased to 900 amperes and 50 volts, complete fusion is obtained in a short time and the sulphur is entirely expelled. The metal prepared in this way, contains sometimes as much as 7 per cent of carbon, about one-sixth of which is in the form of graphite. This carbon may be removed by heating with molybdic oxide.

Metallic molybdenum prepared by any of the above methods is a malleable white metal of silvery lustre and has a specific gravity of 9·01. It is sufficiently hard to scratch glass and can be welded, filed and polished with ease. It has a high melting point, but in the electrical furnace may be fused with ease. It takes up carbon by cementation. Under ordinary circumstances moist air has no effect on it. At 500° to 600°C it takes fire and burns with great brilliancy.

J. Feree (Comptes rendus de l'Académie des Sciences, Vol. CXXII, p. 733) describes the preparation of amalgams of mercury and molybdenum. The molybdenum may be separated from the mercury by distilling off the latter in vacuo at a low temperature. Thus prepared molybdenum is pyrophoric, taking fire in the air with formation of oxides which are volatilized by the heat liberated ; this property is lost when the metal has been heated above 400°C. Nitrogen, carbon

dioxide and hydrogen have apparently no action on the metal either at the ordinary temperature or at a low heat. Carbon monoxide, however, is rapidly decomposed when the molybdenum is gently heated; the metal becomes red hot and absorbs the oxygen of the gas, carbon dioxide being deposited. This modification of the metal becomes incandescent in a current of sulphur dioxide, which is wholly absorbed with formation of sulphide and oxides of molybdenum. Exposed to nitrogen tetroxide, it becomes incandescent, nitride and oxides of molybdenum being formed.

Uses.

Various uses.

Up to within very recent years the use of molybdenum was almost entirely confined to its employment in the form of a molybdate as a laboratory test-reagent for the detection of phosphoric acid. For a time small quantities of molybdenum were employed in the preparation of certain pigments used in the colouring of textile fabrics. But since the introduction of aniline compounds into the dying industry, little, if any molybdenum is now used for this purpose on a commercial scale. Recent experiments of M. E. Pozzi-Escott have demonstrated the possible use of molybdenum salts as a means of imparting a deep yellow colour to leather. Various shades may be obtained by combining these salts with logwood extracts. Lately, molybdenum has gained considerable economic importance through its introduction into the manufacture of certain kinds of steel. In quantities up to about 4 per cent, it has the effect of rendering steel peculiarly hard and tough, with the additional advantage that heating and welding are unattended by any deterioration or change in these qualities.

Different kinds of tool-steel contain from 2 to 4 per cent and a steel containing 3 per cent of molybdenum has been found eminently suitable for the manufacture of armour-plates, owing to the high degree of resistance it offers to the passage of projectiles.

For other purposes, from 1 to 2 per cent of molybdenum is employed, according to the use for which the steel is intended. At the steel-works it is ordinarily added in one or other of three different forms, viz: as dark blue powdered metal, containing 95 to 99 per cent of molybdenum; as ferromolybdenum, containing 50 to 55 per cent of molybdenum; or as molybdenum-nickel, containing 75 per cent of molybdenum and 25 per cent of nickel.

The effect which the addition of molybdenum has on certain other metals—notably lead and copper—has been the subject of attention from a number of investigators, but so far no very definite conclusions seem to have been arrived at and very little has been published in this connection as yet.

Market Requirements.

Market requirements.

Molybdenum ore, to be of marketable quality should contain at least 42 per cent of molybdenum. Ores containing less than this amount must be subjected to concentration by cobbing or other suitable means. It should too as far as possible be uncontaminated by other metallic minerals as the presence of any of these is objectionable and materially reduces the market value of the ore.

The presence of copper especially in any thing more than traces ren ders molybdenum ores valueless as such for commercial purposes, as the cost of its removal by chemical means, more than offsets the present value of the molybdenum.

Sources of Supply.

Sources of supply.

For many years the world's supply of molybdenum ore was drawn almost exclusively from a very few localities in Norway and Sweden. Latterly however the demand has stimulated the production at other centres, notably in Saxony and in the United States of America. Many deposits of molybdenite have been developed in the states of Arizona and New Mexico and are now producing large quantities.

Some localities in the states of Washington and Colorado are also being made productive and a deposit of molybdite near Telluride in the last mentioned state is being operated with success. In Canada, comparatively little has been done in the production of molybdenum ore, although it is known to occur at many localities scattered over a very large area of the Dominion. As to the extent or value of any of these deposits very little is known except from purely surface indications or from the little development work which has been carried on in one or two isolated cases.

Canadian Occurrences.

Occurrences in Canada.

The following list of Canadian occurrences of ores of molybdenum has been compiled from different sources but mainly from the reports of the Geological Survey of Canada.

Province of Nova Scotia.

Canadian occurrences.

Cape Breton county—Along the coast of this county, thick bands of laminated quartz, running with the strike of the felsites contain, in most instances, small quantities of molybdenite. It has also been observed spotting syenitic rock on the Gaspereaux river road.

Shelbourne county—A small vein has been noted in a brooklet tributary to the Jordan river, about six miles above Jordan falls.

Province of New Brunswick.

Charlotte county—Molybdenite has been observed on Trout brook about two miles north of the post road in the parish of Pennfield; in granitic rocks near St. Stephen; and also in quartz veins cutting the granite near Gaspereaux station in the parish of Clarendon.

Gloucester county—Molybdenite has been found in granitic rocks near Bathurst on the Nepisiguit river.

York county—Molybdenite occurs in thin foliated hexagonal plates in quartz veins traversing gneiss at the mouth of Burnt Hill brook, a tributary of the South-west Miramichi river.

Province of Quebec.

Megantic county—At Harvey Hill in the township of Leeds, a fine granular form of molybdenite has been found in some of the short veins of quartz and bitter-spar which intersect the copper-bearing slates of this locality.

Saguenay county—At Quetachoo river, Manicouagan bay, molybdenite has been found in nodules of from one to three inches in diameter and also in flakes a quarter of an inch thick and sometimes twelve inches across in a bed of quartz interstratified in a white coarse-grained gneiss holding garnets and black mica.

Ottawa county.—At the "Trusty Pit" on lot 12, range 12 of the township of Templeton, molybdenite has been found imbedded in iron-pyrites, apatite and pyroxene. And on lot 69, range 4 of the township of Egan, foliated masses of molybdenite are to be found either loose in the soil or imbedded along with lamellar aggregations of brown mica and large quantities of pyrite in a massive pyroxene. The loose condition of the masses of molybdenite in the soil has been ascribed

to the weathering and disintegration of a highly pyritiferous pyroxene. In addition to the above, small quantities of an earthly form of molybdenite occur at this locality. Canadian occurrences.

Pontiac county.—Molybdenite has been noted in the township of Alleyn; on lots 1 and 2, range 3 of the township of Aldfield, where some very fine crystals have been found as well as others of a lesser degree of perfection; on lot 13 of the north range of Calumet island; near Waltham at the mouth of the Black river; and at lake Kewagama to the eastward of Lake Abitibi.

Province of Ontario.

Addington county.—Molybdenite in masses said to reach as many as six inches in diameter is reported to occur in a zone carrying pyrrhotite, pyrite, hornblende, calcite, quartz, pyroxene and black mica on lot 5, concession 14 of the township of Sheffield.

Carleton county.—Molybdenite occurs in considerable quantities in a dyke of felspar cutting crystalline limestone on lot 6, concession 6 of the township of March.

Frontenac county.—Molybdenite has been found on lot 3, concession 8 of the township of Miller.

Haliburton county.—On lot 3, concession 1 of the township of Harcourt, a granular green pyroxenite which has been formed by the complete alteration of a mass of limestone, enclosed in the fundamental gneiss, holds small stringers of an association of molybdenite, pyrite, pyrrhotite, tourmaline and sphene.

Hastings county.—Molybdenite occurs on lots 26 and 27, concession 6 of the township of Monteagle.

Leeds county.—Molybdenite has been noted on lot 14, concession 5 of the township of North Crosby.

Renfrew county—Masses of molybdenite, generally coated with pulverulent molybdite, are distributed rather abundantly through what is probably an intercalated mass of quartz enclosed in gneiss at Rose's mine on lot 22, concession 2 of the township of Ross; molybdenite also occurs in association with apatite, scapolite and titanite in a vein of limestone at Elliott's mine on lot 7, concession 9 of the same township; it also is found on lot 15, concession 10 of the township of

Canadian occurrences.

Bagot; and on lot 16, concession 1 of the township of Brougham, it occurs in large foliated masses.

Victoria county.—Near Mud Turtle lake, on lot 5, concession 2 of the township of Laxton, molybdenite and small quantities of molybdite with which the former is often coated, associated with pyroxene, calcite, black mica, pyrite and a few specks of pyrrhotite and hornblende occur in a quartzose veinstone which traverses the crystalline limestone of the district.

Nipissing district.—Molybdenite occurs as an accessory constituent of quartz-veins in the district immediately around Lake Nipissing.

Rainy River district.—Molybdenite has been noted in small veinlets traversing granitoid gneiss, on Quarry island, Lake of the Woods; and flakes of it are common in a quartz vein at the contact of the Huronian and Laurentian series at the Bear's passage, Rainy lake.

Thunder Bay district.—Molybdenite has been observed near River Dore near Gros Cap above Michipicoten on Lake Superior; also at Black river, and in quartz veins at Terrace cove.

District of Ungava.

Great Whale river.—Molybdenite has been reported from near the mouth of this river.

On Island No. 12 of the Paint Hills group off the east coast of James bay, foliated masses and crystalline plates of molybdenite with a more or less perfect hexagonal outline are found imbedded in a reddish feldspar and a grayish-white subtranslucent quartz, constituents of a pegmatite vein cutting trap at this locality.

District of Keewatin.

Cross lake.—Molybdenite has been found in a pegmatite dyke cutting granite near this lake.

District of Saskatchewan.

Nelson river.—Rounded crystalline aggregates of molybdenite along with occasional crystals of pyrite and magnetite are to be found in

veins of red pegmatite cutting granitite on the Nelson river a short distance from where it leaves Playgreen lake. Canadian occurrences.

Province of British Columbia.

East Kootenay district.—Fine flakes of molybdenite have been found in a quartz vein traversing altered granite near Granite Crossing on the Kootenay river.

West Kootenay district.—Molybdenite has been found at some of the mines in the Trail Creek region. That of the Deer Park mine has been reported to be auriferous. At the Giant claim it is found in bright bluish-gray fine granular masses, sometimes exceeding a foot in diameter, associated with galena, pyrrhotite, chalcopyrite and arsenopyrite.

Yale district.—At a point about three miles south-west of Grande Prairie, fine specimens of molybdenite have been found accompanying chalcopyrite in a gangue composed of a massive clove-brown andradite associated with a light greenish fine-grained pyroxene. Fine specimens of molybdenite have also been found near the headwaters of the south fork of Spuzzum creek.

Lillooet district.—Molybdenite has been observed in the neighbourhood of Lillooet river.

Westminster district.—Molybdenite has been found in association with copper ore near the head of Salmon arm, Jarvis inlet.

Comox district.—Molybdenite has been noticed in the neighbourhood of Knight inlet.

Cowichan district.—(Vancouver island)—Molybdenite has been reported from the upper part of Cowichan river.

Cortez island, Strait of Georgia.—Small quantities of molybdenite have been found in quartz veins in an obscurely stratified hornblendic granitic rock at a point just east of Carrington bay.

Texada island, Strait of Georgia.—Molybdenite has been observed at the Malaspina copper mine, associated with copper- and iron-pyrites in a vein consisting of calcite and quartz, with andradite, tremolite and chlorite as accessory minerals.

Yukon Territory.

White Horse copper region.—Molybdenite is known to occur in some of the prospects in this region.

TUNGSTEN.

Tungsten.

Owing to the similarity of the applications of molybdenum and tungsten in the arts, it has been thought not inadvisable to add here a few notes regarding the latter metal, and to collect together in convenient form, such information as is available, regarding its occurrence in Canada.

The addition of tungsten to steel produces properties almost identical with those produced by the addition of molybdenum. For this purpose, though, it is necessary to add the tungsten in very much greater amount than is the case with molybdenum; 9 per cent of the former produces about the same effect on steel which is obtained with 4 per cent of the latter. It is in this connection that tungsten is for the most part used. Recent experiments have also shown that the addition of tungsten has a very beneficial effect on certain of the aluminum alloys, particularly those with copper. Small quantities of it are also consumed in colouring textile fabrics, and tungstate of soda is used for rendering such materials fireproof.

Ores of.

The most important ores of this metal are scheelite or tungstate of calcium; wolframite, which consists essentially of tungstate of iron; and hubnerite, which consists essentially of tungstate of manganese; there are however many intermediate varieties between the last two types, the iron and the maganese replacing each other in varying amounts.

These ores form frequent accompaniments to tin ores and in some instances have been profitably worked in connection with the gold-washings of placer-mining.

The chief countries producing tungsten ores are England, Austria-Hungary, Germany, Australia and the United States of America.

Canadian Occurrences.

As in the case of the ores of molybdenum mentioned in a preceding list the following enumeration of Canadian occurrences of ores of

tungsten has been compiled almost wholly from the reports of the Geological Survey of Canada.

Province of Nova Scotia.

Inverness county—A deposit of wolframite is mentioned in 'The Mineral Industry' for 1900 as occurring at north-east Margaree and the following analysis is given of the ore : WO_3 66·32%; SiO_2 6·25%; MnO, 12·02%; FeO, 12%. And in the Annual Report of the Geological Survey of Canada, Vol. II, 1898, p. 10 R., is described an occurrence of hubnerite at Emerald on Tom Murphy's brook. This stream empties into Big brook about midway between Pine and Coady brooks which are likewise tributary to Big brook. The mineral was here found associated with small quantities of chalcopyrite and a very little pale yellow hydrous mica, irregularly distributed through a mass of light grayish-white translucent quartz, weighing about a ton and a half, found lying at the outcrop of a lenticular vein of similar quartz some two feet and a half to three feet in width, cutting a gneissic or granitic rock of Pre-Cambrian age. The vein however contained but a comparatively small scattering of the mineral and that only for about a couple of feet. It here occurs in the quartz in the form of narrow seams and small irregular masses having a coarsely laminated structure; it has a brownish-black colour, a submetallic lustre, breaks with a small subconchoidal fracture and affords a brownish-yellow streak. It was found to have a specific gravity at 15·5°C of 6.975 and analysis showed it to have the following composition: WO_3 74·28%; MoO_3 trace; MnO, 22·73%; FeO, 0·47%; CaO, 0·02%; MgO, 0·86%; SiO_2, 1·33%. Wolframite in Inverness county.

Queens county—Scheelite is found associated with a little arsenopyrite and pyrite, in a quartz-lead intersecting the main auriferous vein at the Ballou or Old American mine, Molega gold mining district. It possesses a compact massive structure and shows an uneven fracture; it is light smoke-brown in colour and has a vitreous lustre; it is subtranslucent; has a specific gravity at 15·5°C. of 6.002; and on analysis, yielded the following composition: WO_3, 79·01%; CaO, 19·80%; CO_2, 0·71%; insoluble matter, 0·11%. Deducting the CO_2 together with its equivalent in CaO, to form $CaCO_3$ and also the insoluble matter, and recalculating the remaining constituents for one hundred parts, the following figures are obtained as representing the composition of the mineral; WO_3, 80·70%; CaO, 19·30%. Scheelite Queens county.

Province of Quebec.

Beauce county.—On lot 1 of the 7th range of the township of Marlowe, scheelite occurs in crystals of a pale wine-yellow colour associated with specular iron, pyrrhotite, galena and copper—and iron-pyrites in quartz veins cutting the Cambrian slates of the district. At this locality the scheelite is sometimes accompanied by small quantities of tungstite and meymacite. The mineral has a specific gravity at 15·5° of 6.059 and its analysis showed it to have the following composition: WO_3, 79·90 per cent; Ca O, 19·37 per cent, $Fe_2 O_3$, 0·70 per cent; $Si O_2$, 0.29 per cent.

Province of Ontario.

Simcoe county.—On the north shore of Chiefs island, Lake Coutchiching, Professor E. J. Chapman once found a boulder of Laurentian gneiss in which he observed crystals of wolframite associated with magnetite. These crystals, he found to have a specific gravity of 6.938 and the following composition: WO^3, 73·45 per cent; a substance having the characters of niobic acid, 1·95 per cent; Fe O, 9·05 per cent; Mn O, by difference, 15·35 per cent; SiO^2, 0·20 per cent.

NOTES ON MOLYBDENITE.

By Mr. C. W. Willimott of the Geological Survey.

As the demand for molybdenite has increased very much within the last year or two, more attention is being paid to the search for this mineral, and reports of new finds are reaching us from all parts of Canada. In Ottawa and Pontiac counties, its occurrence may be said to extend, at intervals, over a length of one hundred and fifty miles. At Eardley in Ottawa country it has been found on lot 2, range VIII. In the township of Hull, it is first met with at Eaton chute, near Kirks Ferry, where it occurs sparingly in felspar in small scales. A few yards east of this place, on the bank of the Gatineau river, I observed a number of loose pieces of quartz holding molybdenite in foliated masses. On the west side of the river, on a property belonging to Mr. Featherstonhaugh, a large mass of this mineral was thrown out of one of the pits, while excavating for mica. The next place where I observed this mineral was on lot 6, range I, in the township of Wakefield, but in very small quantity.

On the east side of the Gatineau in the township of Masham, molybdenite has been met with at a number of places. Four miles west of the village of North Wakefield, on the farm of Mr. R. Daly, this mineral occurs in veins and was tested by Mr. Henry, of the Molybdenum Company of Cooper, Maine, U.S., who stated that it ran three and three fifths per cent of molybdenite. At another place in the same township, I observed beautiful hexagonal crystals, about an inch in diameter, on the face of a protruding rock.

In Oldfield, the next township in Pontiac county, on lots 1 and 2 in the third range, a band of grayish pyroxene has been penetrated in several places to a depth of fourteen feet. At the surface, in one of these openings, some very fine crystals of molybdenite were found several years ago by Mr. Chapman, of Belleville, more recently an attempt was made to work this locality, but without satisfactory results. The mineral became very scarce at the depth of a few feet. Among the debris of the pits which had been sunk, I noticed two zeolites, chabazite and stilbite, associated with scapolite.

In the township of Alleyn, in the same county, on lot 1, range II, molybdenite, in small scales, is distributed throughout the country rock. The latter is intersected by felspathic veins that sometimes hold a considerable quantity of molybdenite. On lot 10, range II, of the same

township, this mineral is often turned up by the plough. From this locality to a point forty miles north of Maniwaki, it would be safe to say that molybdenite is found at frequent intervals over a wide range of country. I have seen specimens, said to have come from the townships of Alwin, Wright and Bouchette.

At Mount Cerf on lot 69, range IV, Egan, there is a band of ferruginous pyroxene which is, for the most part, covered with a peaty soil. At one small outcropping on this band, molybdenite makes a considerable showing, and foliated masses and plated crystals of the mineral, sometimes weighing five pounds, were met with. From two shots, I obtained thirty-nine pounds of the pure mineral. I sent two hundred and fifty pounds of the enclosing rock to the Museum, which was later examined by Prof. Porter, of McGill University, who found it still to contain 2·8 per cent, making a total percentage of 15·92. (See Summary Report of the Geological Survey Department for 1900, page 10.)

Molybdenite was also found in loose pieces in the soil about twenty yards off at right angles to the strike. I was shown some very fine specimens of this mineral by an Indian, who stated that they came from the Tomasine river, but I had not an opportunity of visiting the locality.

In the township of Litchfield, on lot 21, range XI, a number of pits have been made in prospecting for mica. During the progress of this research a noticeable quantity of molybdenite was met with in all the pits. From one small pile, I picked out a piece that measured five by four inches and was a quarter of an inch thick. I was informed by the owner of the property that he had seen pieces as large as a dinne plate. This property has been recently well exploited with a view to finding a place that might afford some encouragement to start mining the molybdenite, but so far, I believe, no such spot has been found. From one little pocket I extracted about two pounds of the mineral.